QC – External Synchronization (SYN) S32

Module of the KLIPPEL ANALYZER SYSTEM (QC Version 6.1, dB-Lab 210)

Document Revision 1.2

FEATURES

- On-line detection and compensation delays in the measurement chain (e.g. due to 3rd party audio devices)
- Trigger measurement with incoming synchronization signal
- Fast and robust synchronization
- Integration in Klippel QC
- Tolerant towards for sample rate deviation
- Tolerant towards multi-way sound propagations (e.g. reflections)
- Fast setup
- Customizable sync requests in a task sequence

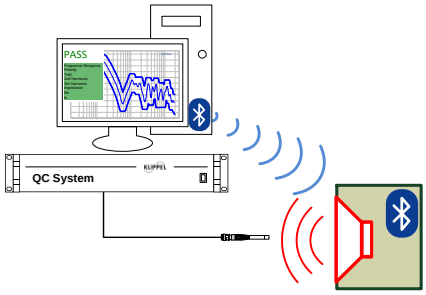
BENEFITS

- Cope with varying delays in open-loop setups (e.g. Bluetooth)
- Use autonomous playback/recording devices
- Independent of signal amplitude
- Electric or acoustical measurement channels
- Test devices with dedicated audio device
- Test devices with unknown delay (e.g. 3rd party audio devices, USB speaker, Bluetooth devices)
- Ultra-fast testing despite unknown delays

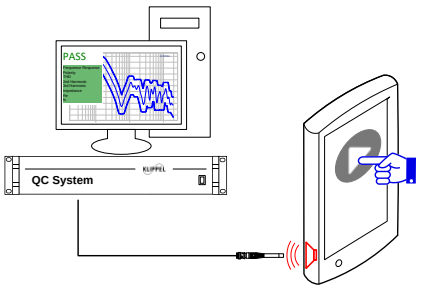
DESCRIPTION

The *External Synchronization* (*SYN*) is an add-on to the QC framework of the Klippel Analyzer System. The module can be applied with all QC measurement tasks for easy setup and handling via the standard user interface.

Synchronization through the measurement channel allows on-line detection and compensation of varying delays in the measurement chain (e.g. Bluetooth/USB speaker).



Furthermore, stand-alone devices (e.g. CD/mp3-Player or tablet computers) with autonomous playback can trigger the analysis by playing back the sync signal.



Applications:

- USB/Bluetooth/digital speakers
- Headphones
- Media players (CD, mp3/ogg/flac/..., mobile phones, tablets)
- Dictaphones
- Automobile audio systems

Article number	1001-107

CONTENT

1 Overview

1.1 Summary

The *External Synchronization (SYN)* provides synchronization through the measurement channel. A synchronization signal (trigger) is detected in the incoming data stream (e.g. signal captured by the microphone). Subsequent measurements and analyses are triggered at the correct points of time.

This technique is necessary to perform high-speed measurements by providing synchronous excitation and analysis for

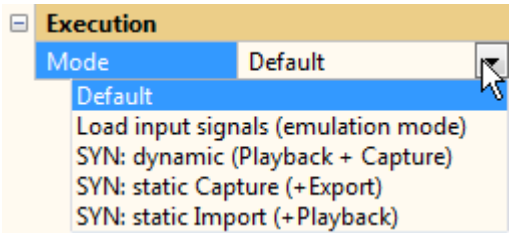
- audio devices with unknown or variable delay (e.g. Bluetooth speaker) or
- audio devices that do not provide an accessible signal input (e.g. tablet computer or media player without AUX input).

1.2 Principle

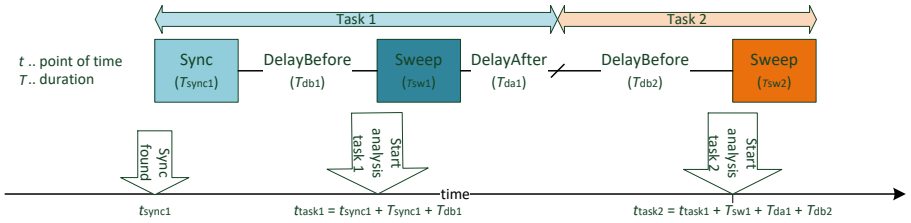
The *External Synchronization* uses a linear modeling technique (impulse response) to detect a synchronization signal in the incoming data stream. The analysis is performed block-wise and the crest factor of each block's impulse response is evaluated to find a valid synchronization.

1.3 Activation and Execution Mode Selection

The *External Synchronization* can be activated in *Control:Start for each QC test sequence*. The defined execution mode applies to the complete test sequence.



SYN Dynamic	See application examples *USB speaker* and *Bluetooth speaker* below. The dynamic execution mode allows synchronizing through the measurement channel, while keeping the test sequence dynamical. This mode is usually applied for devices under test with unknown/changing delay with available signal input and output streams.
SYN Static modes	See application example *Automobile audio system* below. The static execution modes (Capture, Playback, Export and Import) use either the internal signal generator or the internal data acquisition. Arbitrary definable synchronization requests ("trigger points") allow a flexible triggering of the analysis at the correct point of time.



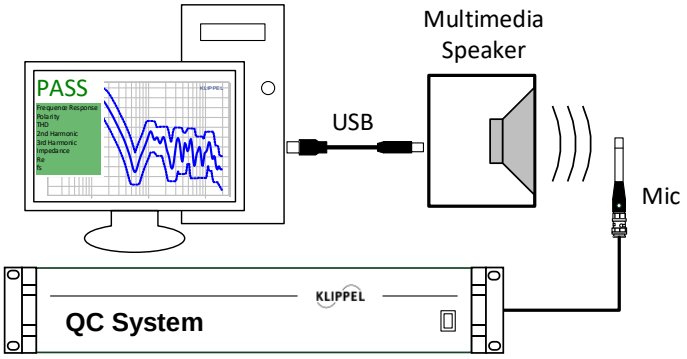
This execution mode is usually applied for devices with inaccessible signal input. For media players the sequence is exported and copied to the device's storage. The playback of the stimulus sequence is completely asynchronous to the analysis in that case.

The timing of the complete sequence must be defined before the measurement.

Synchronization Requests	If *a SYN* execution mode is active, every compatible measurement task may define synchronization requests, which starts a synchronization search in the input signal before the measurement. Several request templates provide a flexible, yet easy configuration.

2 Examples

2.1 USB Speaker

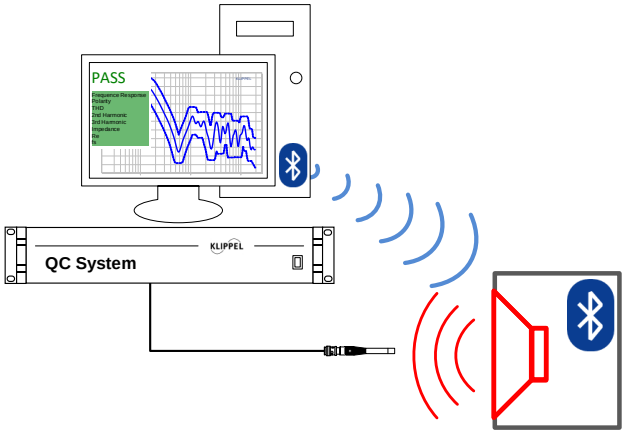


The stimulus is played back with a 3rd party audio device (USB audio device) with unknown delay. The synchronization is performed dynamically through the acoustical measurement channel. Subsequent measurements use the detected delay to trigger the analysis in the quasi-synchronous playback process.

For test signal playback, the speaker audio device is directly used as output sound device.

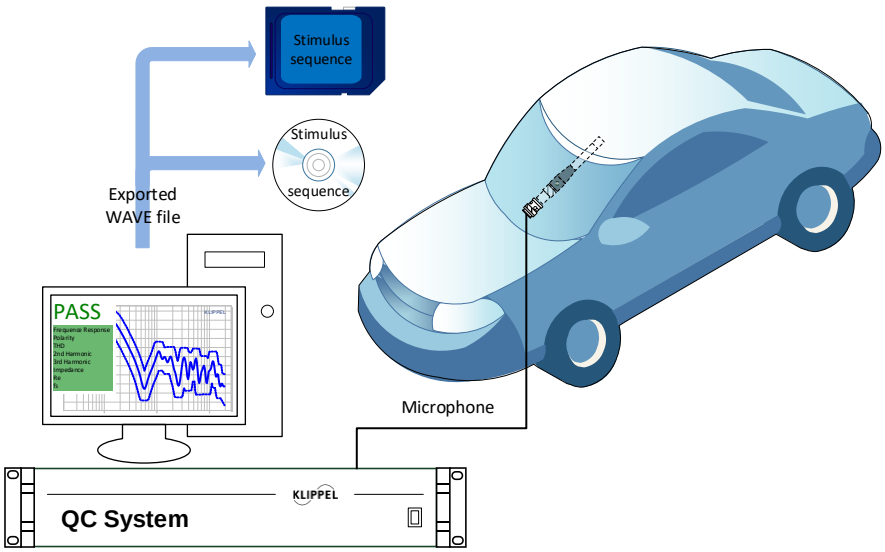
Optionally, additional hardware like 2nd microphone, temperature/humidity sensor, footswitch, etc. may be used.

2.2 Bluetooth Speaker



This setup is similar to the USB speaker example above, but the test signals are transferred wirelessly via Bluetooth.

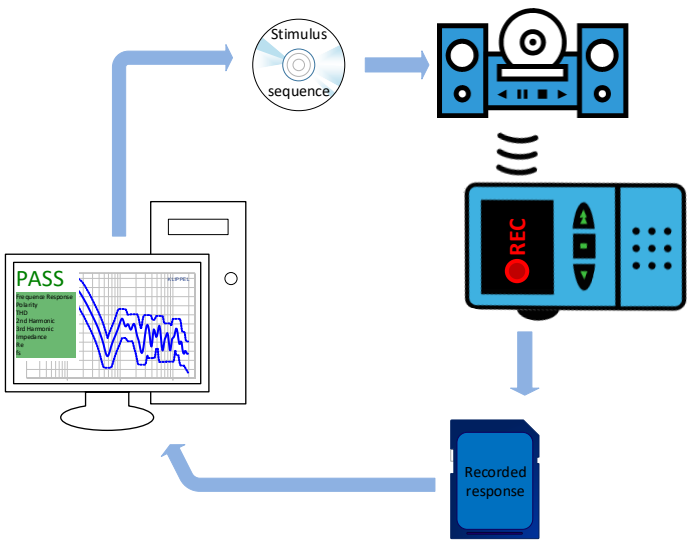
2.3 Automobile audio system



If the device under test (in this example an automobile audio system) does not provide an accessible auxiliary signal input, the stimulus sequence must be transferred offline to the audio system.

This requires fixed timing modes by using static delays between the measurements. The stimulus sequence is generated and exported by the QC system and copied to a suitable medium (e.g. CD or memory card). The playback is performed autonomously by the device under test. The playback of the sync signal triggers the analysis at the correct point of time.

2.4 Handheld Recording Device



For measurements with handheld recording devices that

- do not provide a signal output or
- are used for mobile recordings distant from the analyzing system

the measured response shall be analyzed offline. While recording, the microphone signal is stored in the device's memory. The audio file is imported by the QC software for analysis.

Note: The stimulus sequence may be exported to a WAVE file or directly played back.

3 Requirements

3.1 Hardware

No additional hardware is needed.

3.2 Software

The SYN applies to QC operations only and is available for *Klippel QC* version 4 or later or dB-Lab QC in R&D framework from version 210.

The activation and selection execution mode is available in the *Control:Start* task. The following tasks are able to request synchronization:

- *Sound Pressure (SPL)*
- *Air Leak Detection (ALD)*
- *Coherence*
- *Equalization & Alignment (EQA)*
- *Multitone Distortion (MTD)*
- *Signal Test*

3.3 License

A license and a USB license dongle are required to activate the *SYN.*

4 Parameters

CATEGORY EXECUTION (CONTROL:START)		
Parameter	**Description**	**Available feature options**
External Synchronization	Allows the selecting a SYN execution mode to define synchronization requests	• SYN: dynamic (Playback + Capture) • SYN: static Capture (+Export) • SYN: static Import (+Playback)
CATEGORY EXECUTION (MEASUREMENT TASKS)		
External Synchronization	Request and parameterize the synchronization performed before the measurement.	• No synchronization request • Template: sync2stimulus (stimulus, with 50% repetition) • Template: low-frequency DUT (2 s pink noise sync signal) • Template: mid-frequency DUT (0.5 s pink noise signal) • Template: high-frequency DUT (0.1 s white noise signal) • Custom (enables custom parameters *)

*Custom parameters (available for custom synchronization requests)

		Min	**Default**	**Max**	**Unit**
*Sync Request	Defines the synchronization signal type	• Sync2Stimulus • Pink noise sync signal • White noise sync signal			
*ID (only for pink/white noise)	Unique identifier for noise synchronization signals	1	taskID	1e5	
*Sample rate tolerance	Activates sample rate tolerance for the synchronization. For sync2stim, the end of the stimulus is repeated. If the sample rate tolerance is active, synchronization a sample rate deviation of +/- 10% is detected.	• off • on			
*Crest limit	crest factor limit of impulse response for a valid synchronization	10	25		dB
*Level (only for pink/white noise)	peak level ratio of synchronization signal and measurement stimulus		-3	0	dB
*Time (only for pink/white noise)	Duration of synchronization signal	0.1	0.5	5	s
Max. Sync Tries	Number of synchronization tries. Only available in dynamic mode.	1	3		
High pass	High pass for synchronization process		200		Hz
*Input routing	Input routing for synchronization process	Same as measurement • Mic1 • Line1 • Mic2 • Line2			

*Output routing	Output routing for synchronization	Same as measurement • Out 1 • Out 2 • Out 1 + 2
*Expert parameters	Activation of expert parameters to allow fine tuning of synchronization and processing	ExtSync.MaxTol (maximum tolerance in dB to force selecting the incidence of direct sound, typically -3 .. -6 dB) ExtSync.AnaSyncRatio (ratio analysis block size to synchronization signal duration, typically 1.5 .. 3) ExtSync.Timeout (timeout for synchronization, typically 5 .. 60 s) ExtSync.SrtRatio (ratio of repeated part to complete stimulus, typically 0.1 .. 0.9) ExtSync.WaitBeforeSync (time in seconds the sync search is delayed)

* only visible with a custom synchronization request

5 Results

The main benefit of the SYN module is the triggering of analysis on the correct point of time. Beside the alignment of analysis and measurement several parameters are available in the HTML and Log output.

Parameter	Description
SYN Delay	Detected delay between playback and capture process. This is the delay that is compensated in subsequent measurements.
SYN Crest Factor	Detected crest factor of successful synchronization
SYN Sample rate factor	Detected sample rate deviation between capture and playback processes.

Find explanations for symbols at:
http://www.klippel.de/know-how/literature.html
Last updated: July 09, 2018